Continued Environmental Microbiology Monitoring of the International Space Station (ISS) Veggie Unit Used for In-Flight, Crop-Based Food Systems

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Microbial Monitoring Objectives

- Characterize the microbial community of the Veggie system to yield a **baseline of microorganisms** that can be used to develop **microbial requirements** for spaceflight-grown produce and provide inputs to **future plant system design**.
- The data collected in this study may be used to get a better understanding of the **sources of plant system contamination.**
- Sources of contamination to ISS cabin.

Veggie Hardware

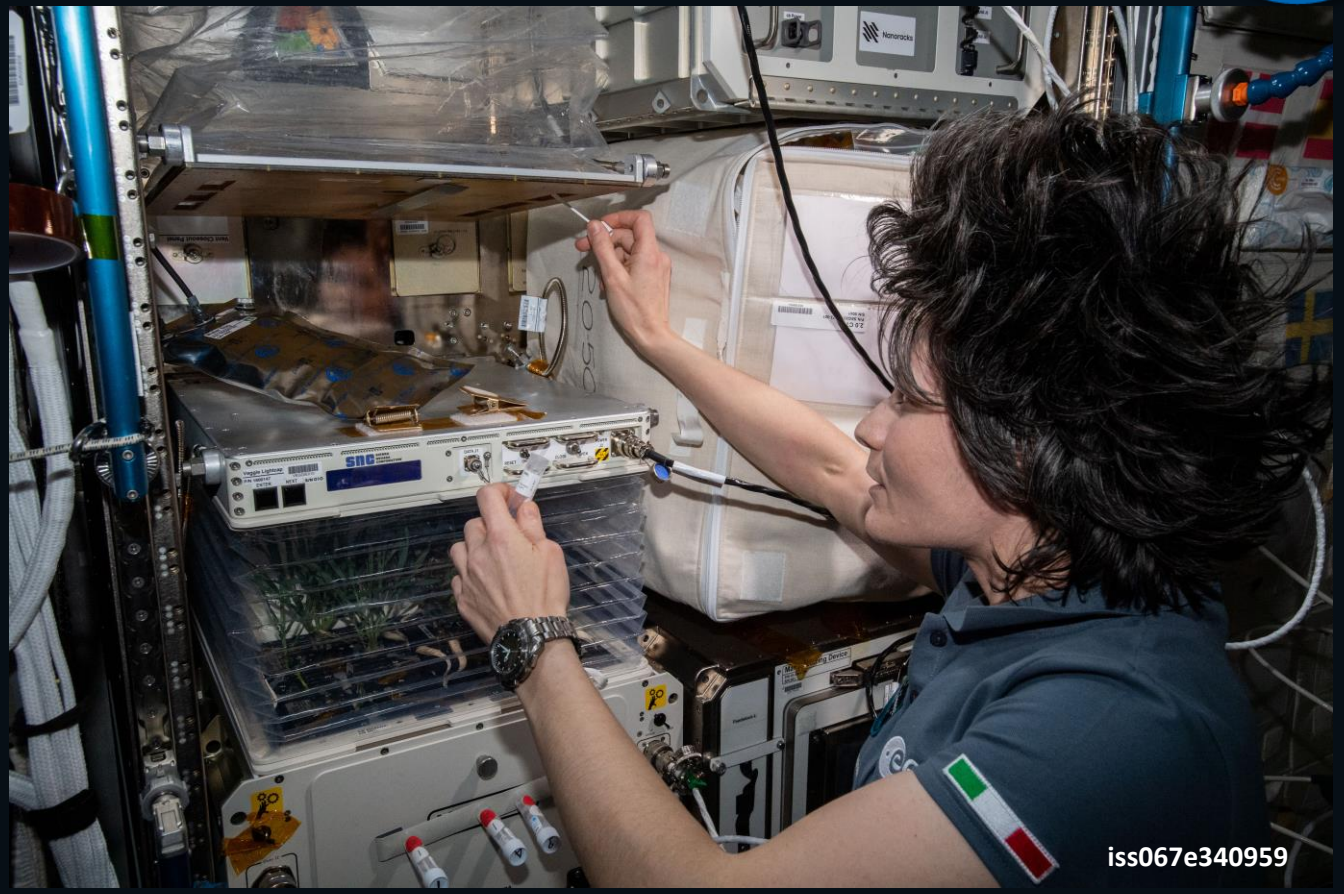
- On board since 2014
- Components
  - Light cap
  - Bellows
  - Baseplate
- Essential in future exploration

Microbial Veggie Monitoring

- First microbial sampling session conducted Fall 2019
  - 11 Samples completed
- Sampled concurrently with Environmental Health System (EHS) samples

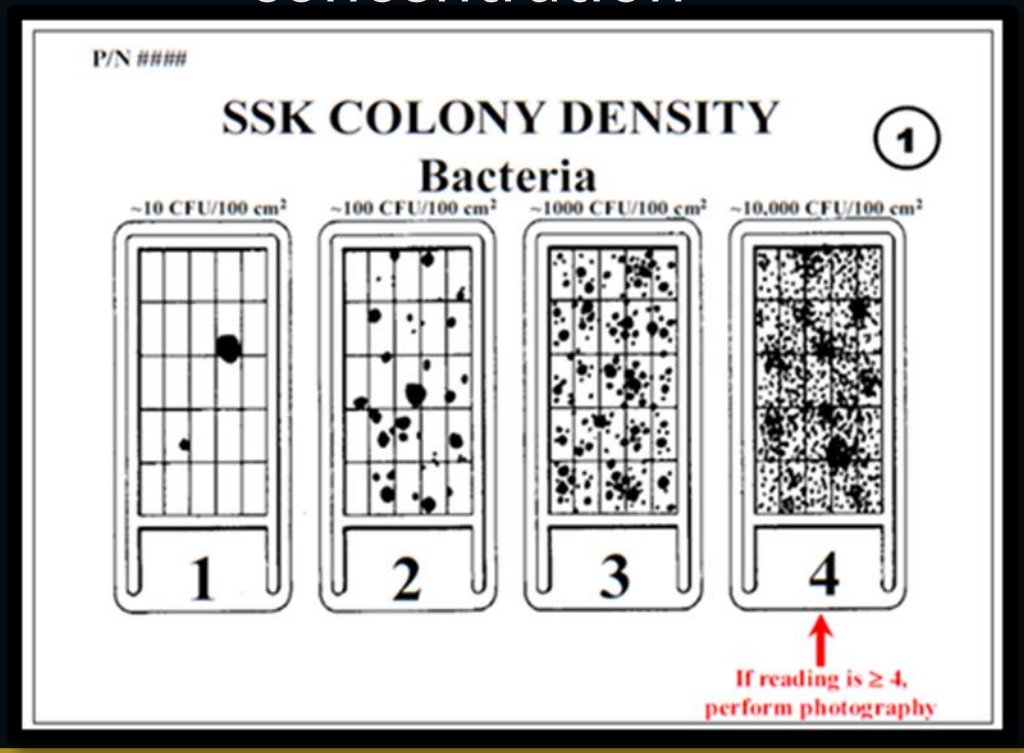
Sample Collection

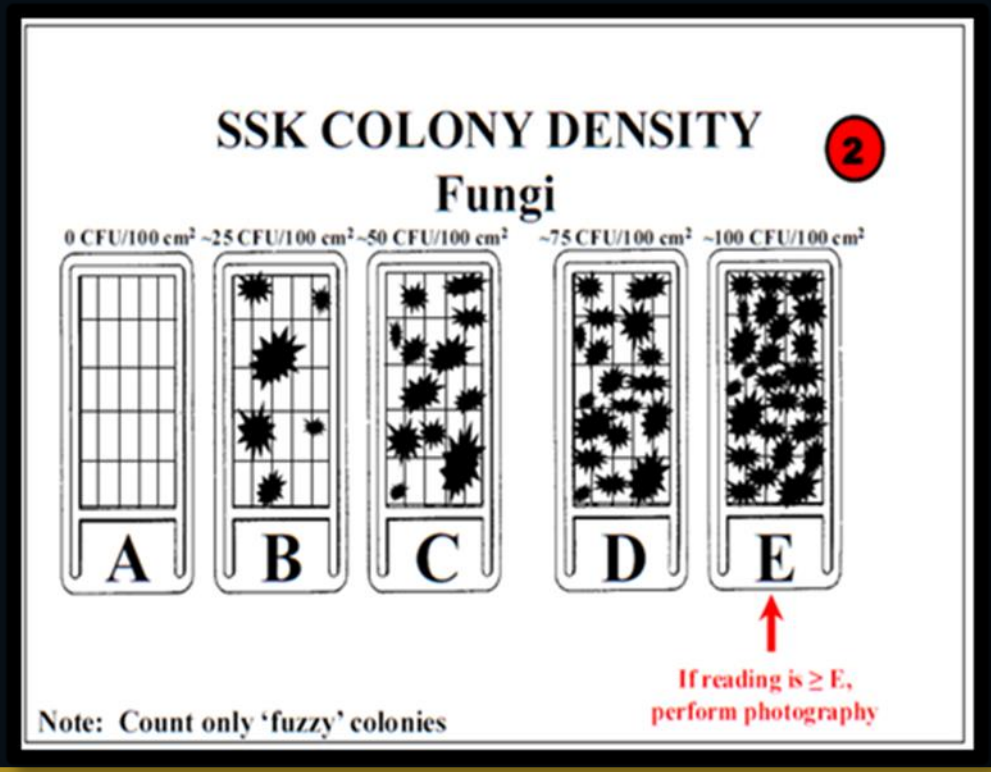
- 4 sampling locations are preselected
- Surface Sampling Kit (SSK)
- Eight Veggie slides
  - 4 Bacterial
  - 4 Fungal



In-Flight Analysis

- Astronauts provide approximation of microbial concentration





Ground Analysis

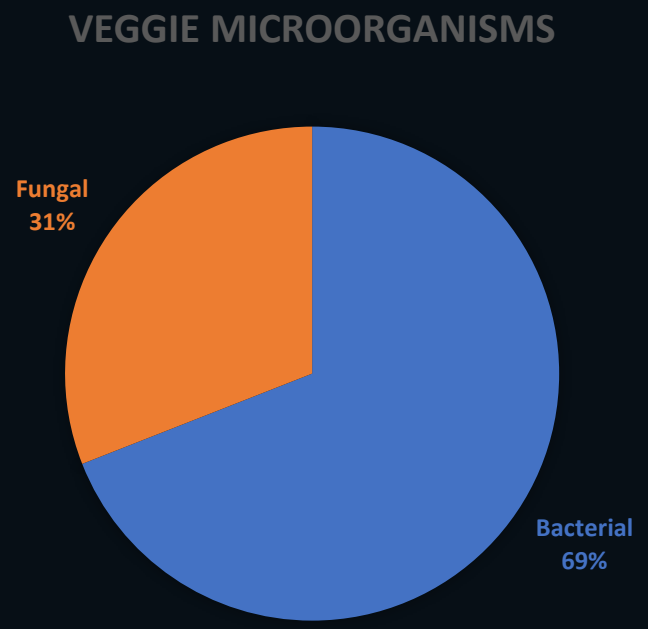
- Samples arrive at NASA JSC Microbiology Lab
- Distinct macroscopic morphology
- Subculture on optimal growth media

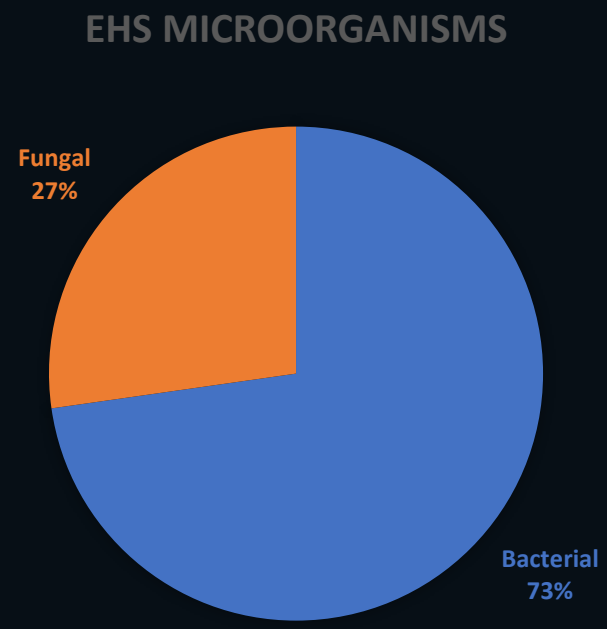
Identification

- Microscopic Morphology
- Biochemical Profiling
- Sanger Sequencing
  - 16S and Large Subunit LSU

Results

- Comparable percentages
- Higher diversity in EHS samples





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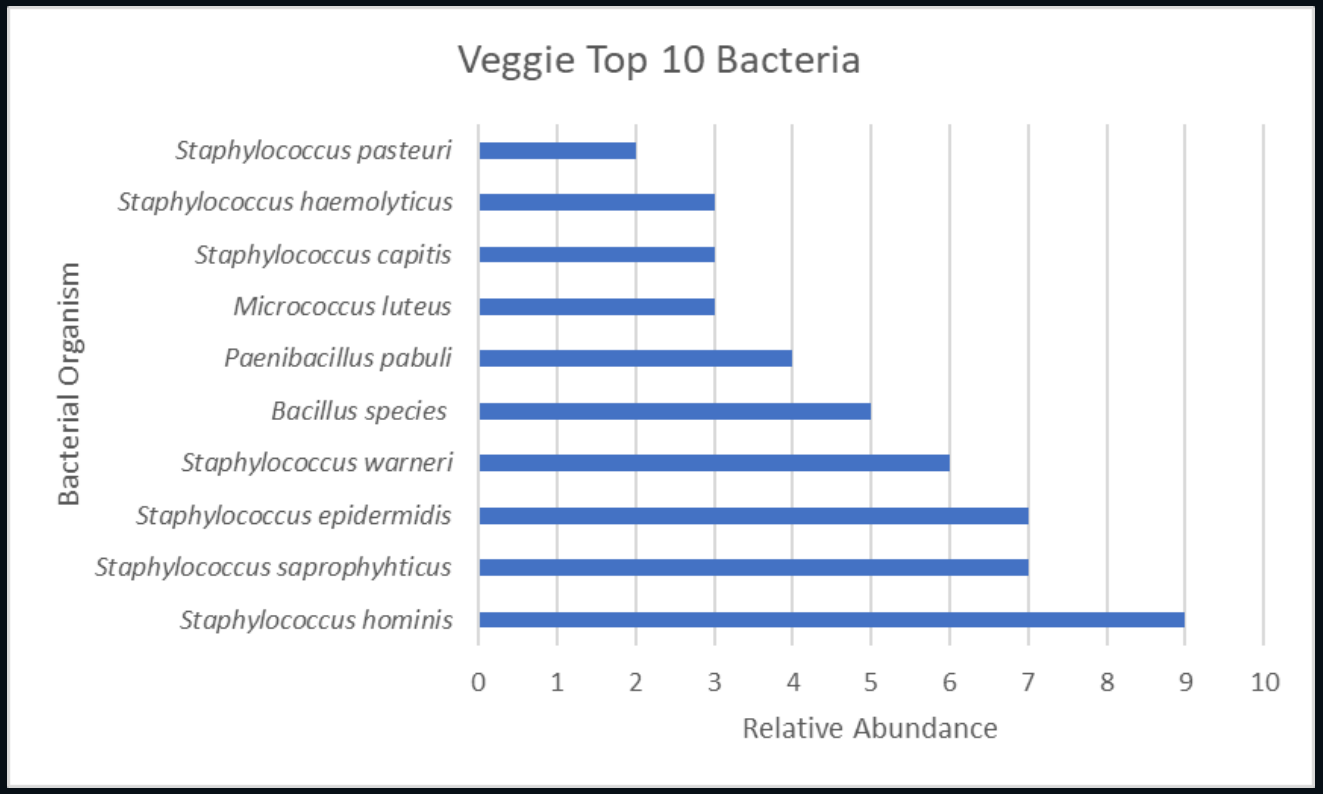
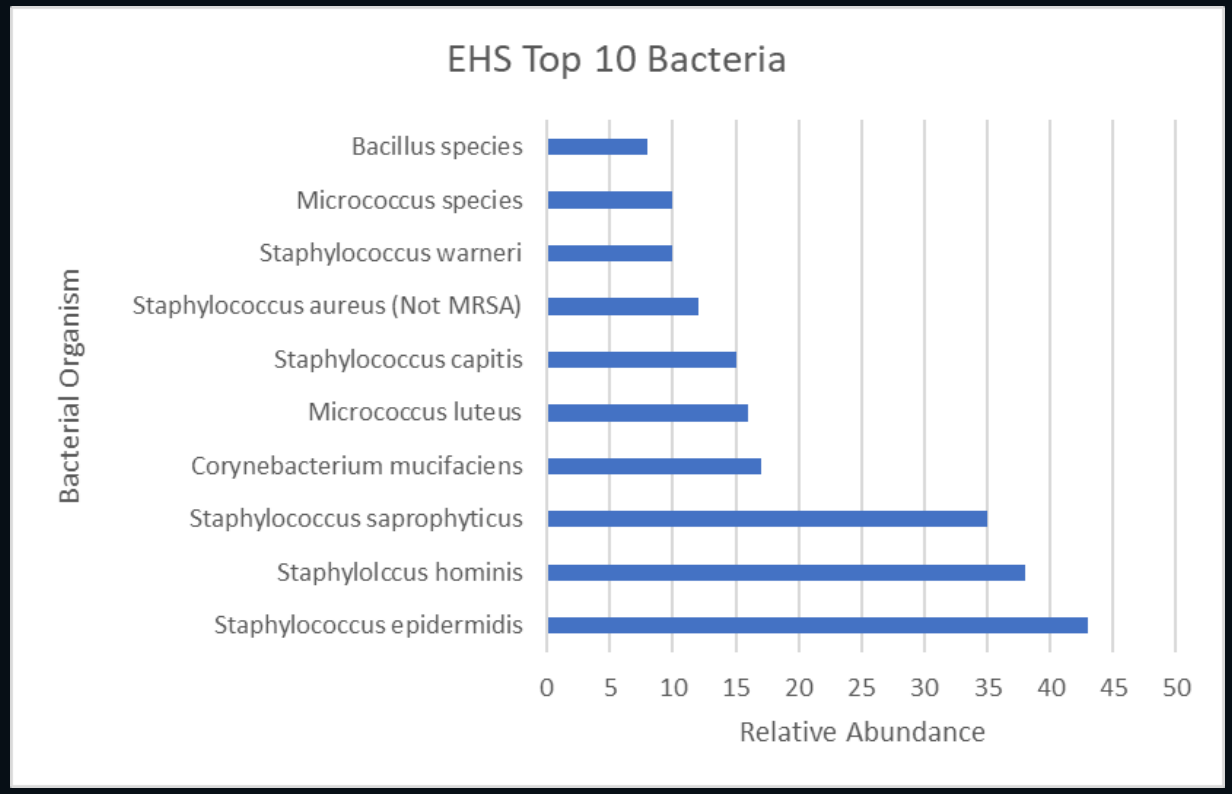
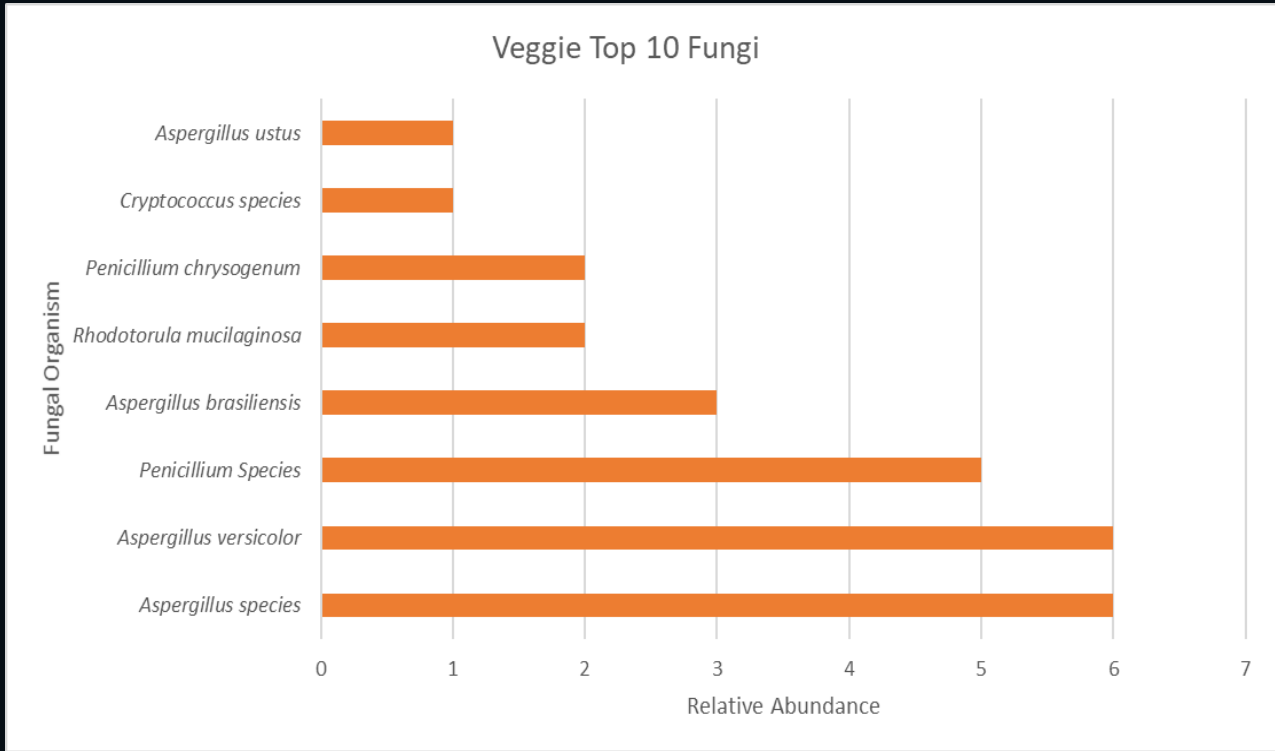
Bacterial Results

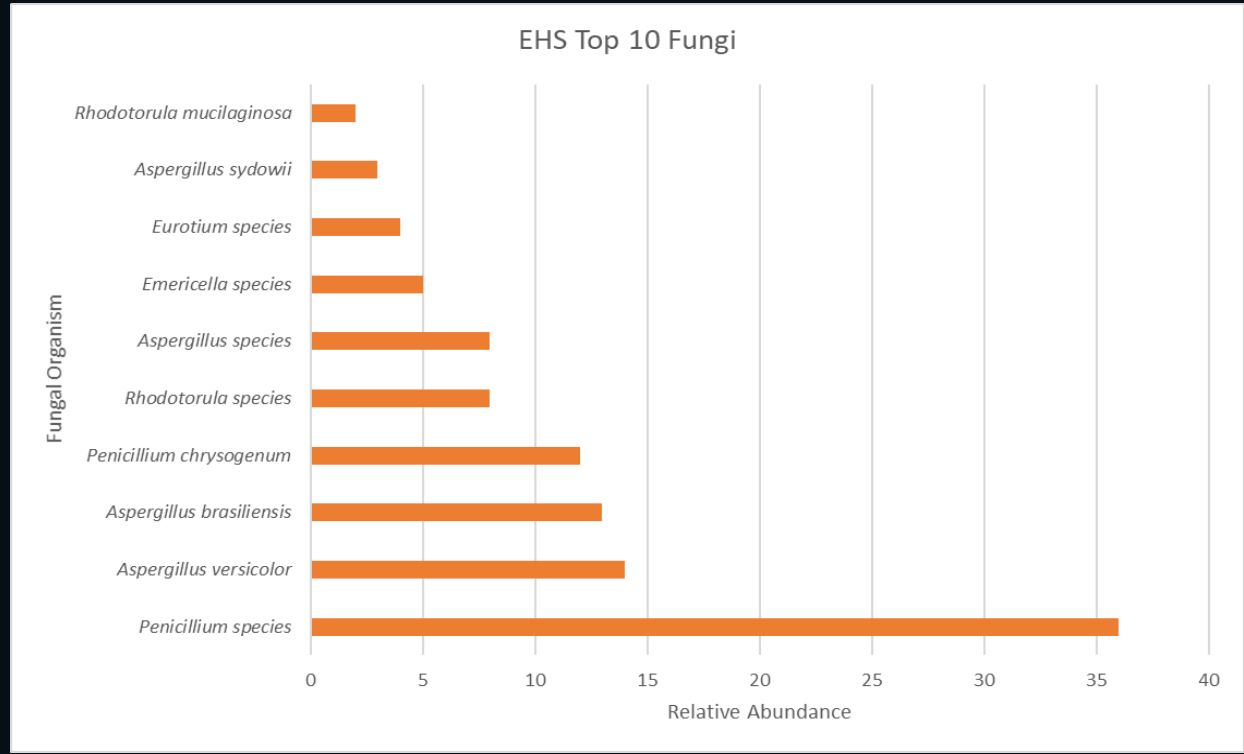




* Relative abundance = Times Organism was Recovered

Fungal Results





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Discussion

- Veggie results comparable to EHS samples.
- Overwhelming majority of human commensal organisms.
- Baseline for future risk assessment.

Future Work

- Further develop a baseline microbial community for Veggie unit to help assess risks, create in-flight crew health requirements, and develop strategies.
- Collaborations to make use of data when designing an updated crop-based food system.
- Investigate possible transition to EHS operations.

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